Spring 5-7-2021

Developing an Early Mobility Nurse-Led Protocol in Critical Care Patients

Anne Flicek
anne.flicek@mnsu.edu

Developing an Early Mobility Nurse-Led Protocol in Critical Care Patients

Submitted to the Faculty
Of the Department of Nursing
College of Nursing and Health Science
Of Winona State University

By Anne Flicek

In Partial Fulfillment of the Requirements
for the Degree of
Masters of Science

May 7, 2021

Winona State University

COMPLETED SCHOLARLY INQUIRY PAPER APPROVAL FORM

TO: Sonja J. Meiers, PhD, RN, APRN, CNS, PHN, AGCNS-BC
Professor and Director, Department of Graduate Nursing

FROM: Anne Flicek

RE: FACULTY ENDORSEMENT and FINAL REVIEW COMMITTEE

DATE: 5/7/2021

SCHOLARLY INQUIRY PAPER TITLE:

Developing an Early Mobility Nurse-Led Protocol in Critical Care Patients

SCHOLARLY INQUIRY PAPER COMMITTEE:

Chairperson Signature: Julie Ponto, PhD, APRN, CNS

Julie Ponto, PhD, APRN, CNS, AGCNS-BC, AOCNS®

Member Signature: Dawn Bos, PhD, PMHNP, BC

Dawn Bos, PhD, MS, APRN, CNP, FNP-BC, FMHNP-BC

Date of Final Approval by Committee: 5-7-21

Acknowledgement

The completion of this scholarly inquiry paper could not have been possible without the support, encouragement, and assistance of the Mayo Clinic Health System, Mankato Intensive Care Unit. The work of Dr. Syed Khan, Dr. Subhraleena Das, and Stephanie Welle N.P. were instrumental in the success of this endeavor. A sincere thank you to my advisor Dr. Kimberly Langer for her mentorship, guidance, and support through the course of my academic career at Winona State University. A profound thank you to my scholarly inquiry paper advisor Dr. Julie Ponto for her continued guidance, support, and feedback in the completion of this undertaking. Lastly, a genuine thank you to my friends and family.

Abstract

The growth of the medical field has resulted in an increase of patients with co-morbidities. Many patients admitted to the intensive care unit present (ICU) with multiple co-morbidities. These co-morbidities add to the frailty of the patient. Frailty has an increased an increased 6 month mortality rate (Maguet, Roquilly, Lasocki, Asehnoune,…& Sequin, 2014). Hospital stays, specifically ICU stays, are one of the largest expenditures for Medicare. To reduce costs, ICU lengths of stay need to be shortened. A growing body of evidence supports the feasibility, safety, and short- and long-term functional benefits of early mobility. Early mobility can be maintained throughout the stay in the ICU, as well as, the entire hospitalization. Despite its potential benefits, effective early mobility is not widely practiced in the ICU. Therefore, nurses need to advocate for early mobility for patients in the ICU. Current literature supports a nursing-led protocol to prioritize effective early mobilization in the ICU. Future recommendations based on the evidence supports the implementation of a nursing led protocol that focuses on early mobility to decrease a patient's length of stay and improve both functional and psychological outcomes, while maintaining quality care and taking into account the needs of each individual patient and institution.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

For patients hospitalized in intensive care units (ICUs), early mobility is essential for positive patient outcomes (Desmon & Nelson, 2014). Early mobility is both feasible and safe. Yet, patients in ICUs suffer from prolonged immobility, which increases the risk for ICU-acquired weakness, delirium, and negative outcomes. Some of the negative outcomes including impaired exercise capacity (Klein et al., 2018), decreased functional ability for activities of daily living (Nuwi & Irwan, 2018), suboptimal quality of life (Frazer et al., 2015), and extended hospital stays (Negro et al., 2018).

Immobility in mechanically ventilated patients is not only harmful to patients but also very expensive. In the United States, an adult ICU stay costs have increased from $56.6 billion to $108 billion from 2017 to 2018 (SCCM, 2018). Mechanically ventilated and intubated patients require 35% more resources than those not mechanically ventilated (SCCM, 2018). Of these patients, approximately 60% will be adversely impacted by immobility for as long as five years post-discharge (SCCM, 2018). These adverse impacts include acquired weakness, delirium, and other undesirable physical and psychological negative outcomes (SCCM, 2018).

Early mobility is defined as “activities that are carried out from the initial physiological stabilization and that continue during the ICU stay” (Arias-Fernandez, Romero-Martin, Gomez-Salgado, & Fernandez-Garcia, 2018, p. 1194). Arias-Fernandez et. al (2012) also describes early mobility as having a significant effect on a patient’s functional status, muscle strength, and quality of life at the time of discharge. Despite recent studies documenting the safety, feasibility, and improved outcomes of early mobility, (Arias-Fernandez et. al, 2012) many patients remain immobilized during their time in the ICU. At least 25% of patients who received prolonged mechanical ventilation of one week or more developed muscle atrophy and additional pathologic changes of muscles and nerves associated with decreased mobility (Creutzfeldt & Hough, 2015).

One study examined the effectiveness of early mobilization, with a study reported 104 randomly selected patients in an ICU and measured functional status at hospital discharge. The the patients who received early mobilization at a mean of 1.5 days after the onset of mechanical intubation (M = 1.5 days) 59% of the patients had an independent functional status, compared to 35% of the patients in the control group who received early mobility (M = 7.4 days) (Taito, Shime, Ota, & Yasuda, 2016).

Purpose and Clinical Nursing Question

The purpose of this literature review is to determine the best strategies for implementation of an early mobility nurse-led protocol in alleviating functional decline and psychological disturbances associated with an ICU stay. The specific question to be addressed is: In adult in an intensive care unit with >48 hours of mechanical ventilation (P), what effect does the use of an early mobility nurse-led protocol (I) have on the incidence of functional and psychological outcomes (O) at discharge and twelve months after discharge (T) when compared to individuals who did not receive early mobility (C)?

Literature Search

To retrieve and review relevant literature, an electronic database search of CINAHL Plus with Full Text, Science Direct, OVID, PubMed, and Nursing and Allied Health Database was completed using the key search terms: intensive care OR icu OR critical care AND mobility OR mobilize OR mobilise OR mobilization OR mobilization AND adult. The final articles were selected focused on the desired target population, quality of evidence, and the ability to develop a possible intervention to improve clinical practice. Several literature searches were performed from February 2020 to February 2021 to find articles with publication dates of 2012 through 2018. Search strategies can be found on Table 1.

Articles included in this literature review had the following inclusion criteria: mobility program was initiated in the ICU, the population was limited to adults (≥ 18 years of age), and similar of approximately 10 to 15 bed ICUs. Exclusion criteria included patients less than 18 years of age and mobility program initiated after discharge from the ICU.

The articles were rated for the level of evidence according to Sackett's Levels of Evidence grading criteria (Table 2) and compiled into a literature table (see Table 3) to assist in proceeding with the narrative data appraisal and synthesis. A total of thirty-six articles were reviewed. Ten studies (one prospective, longitudinal study, one observational study, one prospective quality improvement project, one integrative review, four systematic reviews, and two retrospective longitudinal study) were selected for final analysis.

Background

The ABCDEF bundle mnemonic stands for: **A**wakening and spontaneous **B**reathing trials, **C**areful choice of sedative, **D**elirium assessment, **E**arly mobility, and **F**amily Involvement (Marra, Ely, Pandharipande, & Mayur, 2017). However, many ICUs focus on 'ABCD' and physical therapy (PT) will often defer the patient's assessment until extubated. PT tends to manage the 'E' in the bundle, which results in patients remaining immobilized for long periods of time. This increases the incidence of complications to occur, increases occurrence of ICU-acquired weakness, and extends hospital stays and eventually transitional care services after discharge from the hospital. Several publications focus on nurses implementing and managing the mobility of the patients in a safe and feasible way (Table 4). Therefore, it is beneficial to understand potential barriers in implementing an early mobility protocol as part of routine nursing care as well as strategies to ensure success. Financial implications and length of stay are

some of the few factors driving the need for change. Early mobilization is recommended as the new standard of care for stable but critically ill intubated patients in the ICU.

Financial Implications

Healthcare institutions measure many different types of reimbursement schemes. A reimbursement scheme is also considered diagnosis-related groups (DRG). A DRG is a patient classification system that provides standardized prospective payment to hospitals based on principle diagnosis, secondary diagnosis, comorbidities and complications, surgical procedures, age, sex, and discharge status of the patients treated (HMSA Provider Resource Center, 2018). Reimbursement for an ICU is more complex than any other area of healthcare. An ICU is considered the most expensive department in the hospital. The ICU houses less than 10% of the total hospital beds, but ICU care represents approximately one-third of total healthcare costs (Hunter, Johnson, Coustasse, 2020). The daily average cost in the ICU is $3,968 per day (Kaier, 2020). This is due to high costs of personnel, equipment, expensive medical devices, infrastructure, procedures, and high-care needs.

The National Health Expenditure Accounts (NHEA) provides official estimates of total healthcare spending in the United States (US). These data include expenditures on healthcare goods and services, public health activities, net cost of health insurance, government administration, and investment related to healthcare (CMS, 2019). According to The Centers for Medicare & Medicaid Services (CMS) estimated the NHEA growth of 4.6% to $3.6 trillion and hospital expenditures grew 4.5% to $1,191.8 billion in 2018 (CMS, 2020).

There are multiple components that are included in reimbursement for critical care services. These include fee for service, indexes of severity indicated from DRG and Acute Physiology and Chronic Health Evaluation (APACHE) or Sequential Organ Failure Assessment

(SOFA) scores, nursing workload scores, global budget, need for procedures such as mechanical ventilation, tracheostomy, etc. and quality indicators (Vincent, n.d.) Therefore, adequate reimbursement is vital for ICUs to provide quality care that meets the expectations of patients and insurance companies.

Medicare is a significant funding source for ICU stays. Approximately 1.4 million Medicare beneficiaries are discharged from the hospital annually after receiving ICU level of care (Moitra, Guerra, Linde-Zwirble, Walter, & Wunsch, 2016). Medicare determines the amount of reimbursement made to a facility which is primarily based on provider coding for diagnoses and procedures during a hospitalization for diagnoses and procedures. There are other factors related to hospital reimbursement, such as lengthened hospital stays due to complications, additional medication administration, and supportive care provided by nursing and medical staff. This supportive care time is time spent in the patient room providing one to one care, back massages, and nonpharmacological interventions to manage vitals, stress, anxiety, pain, etc. These interventions are not all accounted for in payment, which means these hours spent on certain patient care activities are included in the hospital expenses but not necessarily recouped in insurance reimbursement.

Length of Stay

The average ICU length of stay (LOS) is approximately 3.4 days (Moitra et. al., 2016). An ICU stay can be divided into mechanically ventilated patient stays and non-mechanically ventilated patient stays. Mechanically ventilated patients tend to spend more time in bed due to being critically unstable. Mechanically ventilated and stable patients are more likely to get out of bed on a daily basis (Moitra et. al., 2016). The harms of bedrest far exceed the potential harm caused by rehabilitation services. Every day of bedrest in an ICU decreases muscle strength by

approximately three to eleven percent over the following months and years (Desmon & Nelson, 2014). Therefore, each day that a patient remains in bed, remains in the ICU and in the hospital, has a lasting impact on the patients' quality of life and physical strength. A patient's physical functioning is mostly dependent on two factors of age and duration of bedrest in the ICU (Desmon & Nelson, 2014). Historically, it was believed that bedrest and sedation in the ICU was helpful patients, whereas, it is actually harmful for their long-term recovery.

Early mobility in intubated patients will lead to better patient outcomes (e.g. reduced risk of readmission) and prevent potential complications such as infection, delirium, and death (Hunter, Johnson, & Coustasse, 2014) and other complications including physical, emotional, and mental health or psychological symptoms that can linger long after a patient transfers out of the ICU. The clusters of physical, emotional, and psychological symptoms are referred to as post-intensive care syndrome (PICS) (Cleveland Clinic, 2020).

Appraisal and Synthesis of Evidence

The general findings from the ten research articles indicate that organizations are able to implement an early mobility protocol within the ICU without detriment to patients. Of the articles selected for this appraisal, according to Sackett's Level of Evidence (Ackley, Swan, Ladwig, & Tucker, 2008), there were four articles rated as a level I evidence level, one as level two, three as level four, and two as level five. There were a variety of articles that identified key attributes for successful implementation. These key attributes as described on Table 4 can be further interpreted into four main themes: (a) early mobility is safe and feasible, (b) multidisciplinary team collaboration with different methods of early mobility, (c) improved functional outcomes associated with early mobility, and (d) decreased psychological symptoms experienced when early mobility is initiated. One of these themes is a finding related to

implementation of early mobility being feasible and one is a characteristic of successful schemes, and two are outcomes of early mobility. Other themes were also discovered that weren't as prominent in a majority of the articles. These themes can be found on Table 4.

Safe and Feasible

Early mobility is both safe and feasible was evident in all the articles reviewed. Nuwi & Irwan (2018) found active mobilization to be both safe and feasible and promoted positive outcomes for patients. Active mobilization does not have any noted negative side effects as long as safety standards are initiated to prevent the potential for dislodgment of devices or disconnection of lines. The articles reviewed suggest that early mobility and physical therapy are safe and effective interventions that can significantly impact patient outcomes. The articles looked at different safety components related to early mobility. Some of these safety components include but are not limited to stable hemodynamic status, such as stable blood pressure, heart rate, rhythm etc., ensuring enough staff are present to safely manage equipment and lines, and managing the patient's physiological response to prevent agitation and anxiety. Hassan et al. (2017) discussed that it is both safe and feasible to educate nurses on how to perform active mobilization interventions with ventilated patients. This study focused primarily on the educating and preparing of nurses to ensure safety when implementing the mobility intervention. Mobility is not a traditional nursing responsibility in the ICU so educating the nurses is beneficial in learning a new skill that will improve patient outcomes.

Multidisciplinary Team Approach

Using a multidisciplinary team approach with different mobility methods, was identified because early mobility requires complex clinical routines that require substantial communication among disciplines to ensure timeliness and effectiveness (Klein et. al, 2018). The articles utilized

different types of multidisciplinary approaches with collaboration among nurses, intensivists, physical therapists, respiratory therapists, and unlicensed staff. Multidisciplinary teams have the ability to carry out early mobilization through the use of different methods, including a leveled mobility protocol with different mobility goals needing to be met until moving onto the next mobility level, a nurse-led protocol, a PT-led protocol, or a designated team approach. Negro et al. (2018) describe having different levels of protocols for mobility. These levels of mobility were implemented as an adopted portion of the ABCDE protocol. The protocol was nurse-led and had safety protocols in place to ensure patient safety. This approach was nurse-led but required the multidisciplinary team approach to complete the daily mobility protocol. These levels of mobility include passive range of motion (PROM) active range of motion (AROM), dangling at the side of the bed, getting out of bed, and walking. However, due to not having additional members dedicated to mobility the number of patients mobilized was low. Klein et al. (2018) also presented a mobility milestone protocol. This mobility protocol was also a nurse-led algorithm. In this study a non-nursing staff member was hired to provide encouragement and support for the protocol, whereas Negro et al. (2018) did not hire any extra staff. Klein et al. (2018) had higher success than Negro et al. (2018) with improving mobility, reducing hospitalization length of stay and ICU length of stay, and improved psychological outcomes. Nine out of the ten articles discussed the importance of using the multidisciplinary approach in order to be successful in increasing activity levels and improve patient outcomes.

Krupp et al. (2018) found many studies that had models that didn't clearly describe the role of the nurse in the mobility models. The research suggests that it is not known whether nurses prioritize patient mobility within a routine shift. Frazer et al. (2018) is a dedicated mobility team that focuses on four phases of mobility that include PROM, sitting, standing,

transfers, and ambulation. The study met the goals of reducing the rates of 30-day readmission, reducing hospital-acquired conditions, improving survival rates, lowering hospital costs, decreasing sedation requirements, and attaining Richman Agitation-Sedation Scale (RASS) scores. Therefore, a multidisciplinary approach with designated mobility staff can increase the likelihood of mobility becoming a priority in patient care.

Phelan et al. (2018) synthesized the multidisciplinary team approach in 12 articles. It was reiterated in several articles that communication promoted the coordination of the project team to encourage patient mobility without interfering with other patient care priorities. Seven of the ten articles discussed the need for further research to understand how nurses can initiate mobility and multidisciplinary teams can increase activity in the complex and busy ICU population. The multidisciplinary team approach had the highest levels of evidence of the interventions identified with four of the articles being Level I evidence according to Sackett's Levels of Evidence grading criteria (Table 2).

Improved Functional Outcomes

Early mobilization has the ability to improve functional outcomes, which also emerged as a common theme in the studies reviewed. Functional outcomes were described as shortened ICU stay and increased mobility when comparing pre- and post-intervention strength. The intervention of early mobilization has different approaches. Dias et al. (2015) critically appraised six studies; four randomized controlled trials (RCTs) and two cohort studies. In five of the six studies, the intervention group who received early mobilization had improved functional outcomes when compared to the control group. The sixth article did not find any significant differences in physical function, but the mobility protocol was initiated on the fifth day of

hospitalization versus on one day to four days after admission. Further research is recommended by the authors of the fourth RCT regarding the trajectory of recovery (e.g. short term, long term).

Adler et al. (2012) analyzed fifteen studies to evaluate functional outcomes and patient safety in relation to early mobility. The studies support early mobility in the ICU. The literature included a variety of strong evidence to suggest improvements in functional mobility when early mobility is practiced in the ICU. The articles provided different types of measurements that could affect the generalizability of these studies. The studies included in the review utilized different measurement tools which affected the extent of comparing the findings of the studies. Ronnebaum et al. (2012) compared the effectiveness of two protocols, one protocol mobility protocol and one standard physical therapy protocol. The mobility group was focused on a multidisciplinary approach with an addition of a respiratory therapy component. When comparing the two groups, the mobility protocol group started physical therapy 1.9 days sooner than those with the regular protocol. This resulted in improved functional outcomes for ICU patients, decreased days in the ICU, and decreased days spent on a ventilator. Not only did this study have increase functional outcomes but it also identified a savings of $22,000 per patient in the ICU (Ronnebaum et al., 2012).

Decreased Psychological Symptoms

Decreased psychological symptoms experienced in patients when early mobilization was initiated, was evident in seven of the articles studied. Psychological symptoms in ICU patients can be the result of medication and sedation, and include delirium and agitation. Delirium is one a key component that is assessed during the ACDEF bundle (Arias-Fernandez et al., 2018). However, only two of the ten articles discussed the ACDEF bundle as part of the mobility protocol. Frazer et al. (2015) found that sedation requirements were increased in a routine group

whereas the mobility group wasn't as heavily sedated. It was also found that the mobility group had fewer delirium days than the routine group. Fraser (2015) found that patients who received early mobility had fewer delirium days and required lower sedation levels and the overall RASS score was significantly lower which indicated wakefulness. The CAM-ICU scores were significantly lower than the routine care group.

Gaps in Literature

There were several gaps identified in the literature. There are a lack of studies that compare and contrast different types of patient populations in relation to early mobility. A majority of the studies focused on the medical population in ICUs. Many of the studies had exclusion criteria of surgical patients, neurological patients, and trauma patients. These patient populations have characteristics that may also benefit from early mobility. Many of the studies focused on early mobility as a way to decrease hospital delirium by mobilizing patients to decrease sedation requirements and improve psychological function versus looking at physical and psychological benefits from early mobility. Additional studies with a greater variety of ICU patient populations would improve generalizability.

EBP Model and Conceptual Framework

The use of an Evidence-Based Practice (EBP) model addresses the basic phases of the EBP process. EBP models serve as an organization guide that helps to guide the integration of the most current research to best create and sustain patient care practice. Melnyk and Fineout-Overhold (2015), identify eight different EBP models that are identified for their strength to facilitate the integration of change. The *Iowa Model of Evidence-Based Practice to Promote Quality Care* is the EBP model chosen for this paper. The *Iowa Model*, Figure 1, is known for its ease of use by multidisciplinary health care teams (Iowa Model Collaborative, 2017). This model

is built on the scientific process of using problem-solving steps to identify opportunities that can help improve a current clinical problem. Early mobility is a clinical problem that is multifactorial. In order to properly implement a nurse-led early mobility protocol, the protocol can be adjusted to fit the needs of the specific facility.

Conclusions, Implications, and Recommendations

Introduction

The purpose of this paper was to determine the best strategies for implementation of an early mobility nurse-led protocol to help improve the functional and psychological outcomes of patients who have been mechanically ventilated for greater than 48 hours. Several pathways have been developed to increase patient mobility but there lacks one universal pathway for improved patient outcomes. Nursing plays a crucial role in patient advocacy and serves as the key liaison for communication among the multidisciplinary team. The Iowa Model of Evidence Based Practice to Promote Quality Care was used to evaluate the effectiveness of an early mobility nurse-led protocol has on the incidence of functional and psychological outcomes of ICU patients. Recommendations are for healthcare facilities to develop a standard protocol for nursing staff and physical therapy to work together to mobilize intubated patients in an effort to decrease length of stay and costs, and ultimately improve patient outcomes. A clinical pathway protocol could be implemented across all ICUs, with adjustments made to address the logistics of each specific site (e.g. role of staff included in team, number of staff).

Implications for Nursing

Any protocol that can improve patient outcomes, decrease patient length of stay, decrease patient costs and improve patient's functional and psychological outcomes is a worthwhile consideration from leadership. Nurses are essential as they work closely with patients on a daily

basis, are able to address potential barriers that could inhibit early mobility, and able to assess the situation to ensure patient safety isn't jeopardized. Therefore, convening a multidisciplinary implementation team including leadership is an important first step for EBP.

An early mobility nurse-led protocol has the potential for no additional staff needed for implementation and relatively low startup costs. In order to initiate an early mobility protocol, obtaining a review, buy in, and approval from nursing leadership (e.g. managers, advanced practice providers, nurse administrators) is often necessary. Following buy in from nursing leadership, establishing a team of 'super users' would be beneficial. This team would be modeled after a multidisciplinary team approach (e.g. a provider, nurse, nursing assistant, physical therapy). A mobility program could be initiated by nursing staff after being deemed safe by the provider. A nurse initiated protocol, would trigger physical therapy to communicate with nursing staff with a plan of care for the patient. This will ensure staff is available at the dedicated time, patient care activities are grouped to ensure the patient is ready for mobility and additional staff is available. Other cares and activities can be completed prior to or following mobility pending the patient's individual plan of care. Therefore, the multidisciplinary team approach with efficient and effective communication (e.g. rounds, electronic nurse led protocol) is essential in improving patient outcomes.

Key criteria identified to increase early mobility in intubated patients is driven through nursing. Nurses must use their assessment skills and clinical judgement to ensure early mobility is both safe and feasible for the patient. Therefore, a multi-modal eligibility criteria will be beneficial in ensuring safety. A patient needs to be hemodynamically stable, pain managed, delirium assessed, and able to mobilize pending surgical procedure outcomes. These criteria are dependent on the reason for patient admission and procedures while hospitalized and could be

included in a protocol or algorithm. Without these criteria, a patient may experience uncontrolled pain, impaired level of consciousness, or end up with exacerbated symptoms or injuries. Nurses are essential in participating in early mobilization with patients as nurses spend the most time at bedside their patient developing rapport, knowing the limitations and trends of a patient, and creating patient centered care plans to promote early mobility, decreased hospital length of stay, and improved outcomes. Physical therapists also have essential role in physical therapy and mobility, however, most hospitals only have physical therapy staffed during dayshift. Therefore, it is imperative that nursing staff continue to mobilize the patient throughout the evening and nighttime hours as appropriate.

Lastly, communication is a key component for this protocol to be successful. The nurse needs to advocate for the patient to ensure all their needs are being met during mobilization. Providers can support the nurses' independence in early mobility (e.g. being more specific in activity orders placed, addressing mobility during rounds, encouraging the progression of mobility). The nurse needs to also be the coach/advocate for the patient. They need to encourage and motivate their patients to participate in early mobility. This can be completed by providing patients with information about the benefits of early mobility and create a plan together that will work for both the patient and staff. Patients can require different levels of motivations, which impacts the patient's participation in activity and ultimately the plan of care. Without the collaboration between the patient and the nursing staff, the process of early mobilization may be ineffective (Hassan et. al, 2017). Nurses need to be the main advocate to ensure patient mobility.

Recommendations

The practice question and primary purpose of this scholarly inquiry paper was to synthesize the evidence and identify modalities of treatment for an early mobility nurse-led

protocol in the ICU with the intended outcomes of decreasing cost of care and improving the quality of care for patients. The improvement in the quality of care, will improve patient functional and psychological outcomes, thus decreasing the length of stay and recovery time following hospitalization. This can be completed through practice optimization (e.g. a provider placed order during rounds if criteria is met to trigger nurse led protocol/algorithm) and an established work group that focuses on mobilizing patients during their ICU stay. This practice change can be achieved with the use of the Iowa Model of Evidence-Based Practice as a blueprint to start the project along with quality improvement methods (e.g. Six Sigma, Plan Do Study Act). Quality improvement methods help to optimize practice and ensure quality care. Methods such as the "Six Sigma" or "Plan Do Study Act" (PDSA) can assist in developing an approach that best addresses the concerns of a multidisciplinary team. A nurse-led multidisciplinary approach is the most effective way to meet the needs of patient. The research review completed for this project helped to discover contributing eligibility criteria that could affect a patient's ability to participate in early mobility (e.g. hemodynamically stable, blood pressure support, sedation use).

Based on the Iowa Model of Evidence-Based Practice and the PDSA, a nurse-led protocol would be the recommended approach to promote early mobility. This would require a multidisciplinary approach that wouldn't require extra staff to complete the activities. Effective communication among team members can ensure mobility is achieved. Ultimately, the nurse needs to promote this change and advocate for patients. Nursing staff ultimately have the potential to decrease a patient's hospital length of stay, prevent potential complications, decrease costs, and most importantly improve patient outcomes.

Summary

As the population continues to age, patients present with more comorbidities. The more comorbidities, the sicker the patients, and the higher need for intubation. Patients are doing research to seek information regarding patient outcomes and the ranking of different hospitals. In order for a healthcare facility to rise to the top, they need to figure out ways to provide high quality care, decrease a patient's length of stay, and decrease patient costs. In order to decrease the hospital length of stay, present infection, and prevent complications, early mobility in intubated patients' needs to be a priority in patient care. After an extensive literature search, common themes were identified in decreasing an ICU length of stay. Ultimately, future recommendations based on the evidence supports the implementation of a nursing led protocol that focuses on early mobility to decrease a patient's length of stay and improve both functional and psychological outcomes, while maintaining quality care and taking into account the needs of each individual patient and institution.

References

Adler, J. & Malone, D. (2012) Early mobilization in the intensive care unit: A systematic review. *Cardiopulmonary Physical Therapy Journal*, *23*(1), 5-13

Arias-Fernandez, P., Romero-Martin, M., Gomez-Salgado, J., & Fernandez-Garcia, D. (2018). Rehabilitation and early mobilization in the critical patient: systematic review. *The Journal of Physical Therapy Science, 30*: 1193-1201.

Atkins, J. & Kautz, D. (2014). Move to improve: Progressive mobility in the intensive care unit. *Dimens Critical Care Nursing, 33*(5), 275-277. Doi: 10.1097/DCC.0000000000000063

Bittner, Donnelly, Zantan, Anderson…Schmutz. (2013) How is intensive care reimbursed? A review of eight European countries. *Ann Intensive Care.* 3(37). doi: 10.1186/2110-5820-3-37

Cleveland Clinic (2020). Post-intensive care syndrome (PICS). Retrieved from https://my.clevelandclinic.org/health/diseases/21161-post-intensive-care-syndrome-pics

CMS. (2019). Design and development of the diagnosis related group (DRG). Retrieved from https://www.cms.gov/icd10m/version37-fullcode-cms/fullcode_cms/Design_and_development_of_the_Diagnosis_Related_Group_(DRGs).pdf

CMS. (2019). Historical. Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical#:~:text=The%20National%20Health%20Expenditure%20Accounts,spending%20in%20the%20United%20States.&text=U.S.%20health%20care%20spending%20grew,spending%20accounted%20for%2017.7%20percent

CMS. (2018). NHE face sheet. Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet

Creutzfeldt, C. & Hough, C. (2015). Get out of bed: Immobility in the neuro ICU. *Critical Care Medicine.* 43(4), 926-927. doi: 10.1097/CCM.0000000000000836

Desmon, S. & Nelson, L. (2014). Longer stay in hospital ICU has lasting impact on quality of life. *John Hopkins Medicine.* Retrieved from https://www.hopkinsmedicine.org/news/media/releases/longer_stay_in_hospital_icu_has_lasting_impact_on_quality_of_life

Dias de Silva Azvedo, P. & Gomes, B. (2015). Effects of early mobilization in the functional rehabilitation of critically ill patients: A systemic review. *Journal of Nursing Referencia.* 129-138. http://dx.doi.org/10.12707/RIV14035

Fraser, D., Spiva, L., Forman, W., & Hallen, C. (2015). Original research: Implementation of an early mobility program in an ICU. *American Journal of Nursing, 115*(12), 49-58.

Hassan, A., Rajamani, A., & Fitzsimons, F. (2017). The MOVIN' project (Mobilisation Of Ventilated Intensive care patients at Nepean): A quality improvement project based on the principles of knowledge translation to promote nurse-led mobilization of critically ill ventilated patients. *Intensive and Critical Care Nursing*, *42*, 36-43. http://dx.doi.org/10.1016/j.iccn.2017.04.011

HMSA Provider Resource Center (2018). Diagnosis related group. Retrieved from https://hmsa.com/portal/PROVIDER/zav_pel.fh.DIA.650.htm

Hunter, A., Johnson, L., Coustasse, A. (2014). Reduction of intensive care unit length of stay: the case of early mobilization. *Health Care Management.* 33(2), 128-135. doi: 10.1097/HCM.0000000000000006. PMID: 24776831.

Hunter, A., Johnson, L., Coutasse, A. (2020). Reduction of intensive care unit length of stay. *The Health Care Manager.* 39(3), 109-116. doi: 10.1097/HCM.0000000000000295

Iowa Model Collaborative (2017) Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing* 14(3), 175-182. doi: 10.1111/wvn.12223

Kaier, K., Heister, T., Wolff, J., & Wolkewitz, M. (2020). Mechanical ventilation and the daily cost of ICU care. *BMC Health Services Research.* 20. https://doi.org/10.1186/s12913-020-05133-5

Klein, K., Bena, J., Mulkey, M., & Albert, N. (2018). Sustainability of a nurse-driven early progressive mobility protocol and patient clinical and psychological health outcomes in a neurological intensive care unit. *Intensive and Critical Care Nursing*, *45*, 11-17. http://dx.doi.org.wsuproxy.mnpals.net/10.1016/j.iccn.2018.01.005

Krupp, A., Steege, L., King, B. (2018). A systematic review evaluating the role of nurses and processes for delivery interventions in the intensive care unit. *Intensive and Critical Care Nursing*, *47*, 30-38. DOI: 10.1016/j.iccn.2018.04.003

Kılıç, Yuzkat, Soyalp, & Guihas. (2019) Cost analysis on intensive care unit costs based on the length of stay. *Turkish Journal of Anaethesiology and Reanimation.* 47(2). 142-145. doi: 10.5152/TJAR.2019.80445

Maguet, P., Roquilly, A., Lasocki, S., Asehnoune, K., Carise, E., Martin, M., Mimoz, O., Gac, G., Somme, D., Cattenoz, C., Feuillet, F., Malleda, Y., & Seguin, P. (2014). Prevalence and impact of frailty on mortality in elderly ICU patients: A prospective, multicenter, observational study. *Intensive Care Medicine.* 40, 674-682.

Marra, A., Ely, E.W., Pandharipande, P., & Patel, M. (2017). The ABCDEF bundle in critical

care. *Critical Care Clinic, 33*(2), 225-243. Doi: 10.1016/j.ccc.2016.12.005

Moitra, V., Guerra, C., Linde-Zwirble, W., & Wunsch, H. (2016). Relationship between ICU length of stay and long-term mortality for elderly ICU survivors. *Critical Care Medicine.* 44(4). 655-662. DOI: 10.1097/CCM.0000000000001480

Negro, A., Cabrini, L., Lembo, R., Monti, G., Dossi, M., Perduca, A., Colombo, S., Marazzi, M., Villa, G., Manara, D., Landoni, G., & Zangrillo, A. (2018). Early progressive mobilization in the intensive care unit without dedicated personnel. *Canadian Journal of Critical Care Nursing,* 29(3), 26-31. https://doi.org/10.1016/j.iccn.2018.01.005

Nuwi, D. & Irwan, A. (2018). Effect of active mobilization on patients in the intensive care unit: A systemic review. *International Journal of Caring Sciences*, *11*(3), 1942-1953. ISSN: 1791-5201.

Phelan, S., Lin, F., Mitchell, M., & Chaboyer, W. (2018). Implementing early mobilization in the intensive care unit: An integrative review. International Journal of Nursing Studies, *77.* 91-105. http://dx.doi.org/10.1016/j.ijnurstu.2017.09.019

Ronnebaum, J., Weir, J. & Hilsabeck, T. (2012). Earlier mobilization decreases the length of stay in the intensive care unit. *Journal of Acute Care Physical Therapy, 3*(2), 204-210. ISSN: 2158-8686

Society of Critical Care Medicine. (2018) Critical care statistics. Retrieved from https://www.sccm.org/Communications/Critical-Care-Statistics

Taito, S., Shime, N., Ota, K., & Yasuda, H. (2016). Early mobilization of mechanically ventilated patients in the intensive care unit. *Journal of Intensive Care*, *4,* 50. DOI 10.1186/s40560-016-0179-7

Vincent, J. (n.d.) Impact of reimbursement schemes on quality of care: A European perspective.

American Journal of Respiratory and Critical Care Medicine. 185(2).

https://doi.org/10.1164/rccm.201108-1472ED

Appendix A: Tables

Table 1

Database Searched and Data Abstraction

Date of Search	Keyword Used	Database/Source Used	# of Hits		
			Listed	Reviewed	Used
2/4/2020	Mobility AND Intensive Care Unit AND Intubated	CINAHL		1	1
2/4/2020	Early Mobility And Nursing AND Protocol	CINAHL		2	0
2/23/2020	Mobility OR Intensive Care AND Functional Decline	Nursing & Allied Health Database		2	0
2/26/2020	intensive care OR icu OR critical care AND mobility OR mobilize OR mobilise OR mobilization OR mobilization AND adult	CINAHL	471	10	4
2/26/2020	intensive care OR icu OR critical care AND mobility OR mobilize OR mobilise OR mobilization OR mobilization AND adult	Science Direct	938,875	12	3
3/16/2020	Intensive care AND mobility AND adult AND systematic review	OVID	44	4	1
3/18/2020	Intensive care AND mobilization AND adult AND systematic review OR meta-analysis	PubMed	91,286	5	1

Table 2
Level of Evidence Grading Criteria

Level of evidence	Description
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.
Level II	Evidence obtained from at least one well-designed RCT (e.g. large multi-site RCT).
Level III	Evidence obtained from well-designed controlled trials without randomization (i.e. quasi-experimental).
Level IV	Evidence from well-designed case-control or cohort studies.
Level V	Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis).
Level VI	Evidence from a single descriptive or qualitative study
Level VII	Evidence from opinion of authorities and/or reports from expert committees
References: Ackley, B. J., Swan, B. A., Ladwig, G., & Tucker, S. (2008). *Evidence-based nursing care guidelines: Medical-surgical interventions.* (p. 7). St. Louis, MO: Mosby Elsevier.	

Table 3
Literature table

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Klein, K., Bena, J., Mulkey, M., & Albert, N. (2018) Sustainability of a nurse-driven early progressive mobility protocol and patient clinical and psychological health outcomes in a neurological intensive care unit. *Intensive and Critical Care Nursing.* 45, 11-17. https://doi.org.wsuproxy.mnpals.net/10.1016/j.iccn.2017.01.005 Database: ScienceDirect	-Determine impact of an early mobility protocol on mobility level and clinical outcomes over a 22-month period by comparing levels of mobility over time (p. 12) -Examine if clinical outcomes and psychological health in the Neuro ICU differed over time between three groups (p.12)	-22-bed Neurological ICU within a 1400 bed quaternary-care medical center in Ohio. N = (1117) -Three study groups with 150 participants. (p. 12) -N = 260 pre-intervention -N = 377 post-implementation -Randomly controlled study -Inclusion criteria - critically ill, mechanically ventilated adults in Neuro ICU -Exclusion criteria- non-English speaking, confusion, delirium, combativeness, comatose state, and inability to complete psychological history questionnaire.	-Prospective, longitudinal, comparative study. Three group study at three points in time. (p. 12) Instruments -Psychological health measured with Brief Symptom Inventory. -Case report and data collection created using Milestones. -Apache scores -ANOVA models (p. 13-14)	"Discharge to home increased from preintervention to immediate post intervention and remained above the pre-EPM protocol implementation rate (p = .007)" (p. 14) "No difference in VAP, BSI, DVT, HAPI, and 30-day mortality rate" (p. 14) "Psychological health (depression, anxiety, and hostility) improved ($p = \leq 0.006$). (p. 14)	"An early progressive intensive care mobility programme is safe and effective in achieving a reduction in hospital length of stay and psychological distress" "An out-of-bed mobility protocol is sustainable" "When patients in an intensive care unit with neurological injuries are adherent to early mobility programme expectations, they may have improved psychological health" (p.11)	Themes - Decreased mobility in ICU - Prolonged hospitalization - Psychological health complications - Nurse driven mobility program - Pre-Intermediate-Post- intervention Groups - 16 levels of physical mobility rating - Post ICU - Large sample size - Internal threats to validity could have weakened findings -Unit environment, including personnel, were stable during study period	Level IV

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Negro, A., Cabrini, L,, Lembo, R., Monti, G., Dossi, M,, Perduca, A., Colombo, S,, Marazzi, M., Villa, G., Manara, D,, Landoni, G,, & Zangrillo, A. (2018). Early progressive mobilization in the intensive care unit without dedicated personnel. *Canadian Journal of Critical Care Nursing, 29(3),* 26-31. Database: CINAHL Complete	-To assess feasibility and safety of an early progressive mobilization protocol implemented without dedicated personnel, as part of the ABCDE bundle	-Eight-bed general ICU of a teaching hospital in Italy. -482 patients were admitted with a mean age of 79.5 -356 mobilization sessions completed -Data collection lasted one year -Inclusion – mechanically ventilated -Exclusion – dying patients, patients to be discharge1d in the next few hours, no emergency occurring in ICU. -Safety criteria – alert, hemodynamic stability (no cardiac ischemia, no increase in vasopressor dose in past 2 hours, no arrhythmia onset in last 24 hours) and respiratory stability (Fi02 $\leq$ 0.65, PEEP < 12 cmH20)	-Observational Study. -Nurses kept mobilization diary for each patient and stages of mobility were recorded. -Categorical data presented as absolute numbers and percentages and compared by two tailed x2 test or Fisher's exact test. -Continuous measurements were compared using the Mann-Whitney U test or T test. -Two-sided significance tests were used throughout. -Statistical analyses were performed with the STATA software	-A mean Simplified Acute Physiology Score (SAPS) II score of 31.33 and a mean Sequential Organ Failure Assessment (SOFA) score of 5.25. -94 (19.5%) patients were mobilized. -34 patients were mobilized while mechanically ventilated. -Mobilized patients had longer ICU and hospital length of stay and better ICU survival rate - No patients were mobilized during non-invasive ventilation -Sixteen patients were mobilized while on vasopressors.	-Implementation of the early and progressive mobility protocol was feasible and safe without dedicated personnel. -Number of mobilized patients were few. -"Further research is required to evaluate the efficacy and generalizability of our strategy and the additional nurse-workload" p. 28	Themes - Decreased mobility in ICU - Prolonged hospitalization - 6 levels of the early mobilization protocol -Implemented without additional dedicated personnel -Type of mobility summarized on charts every 3 months	Level IV

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Hassan, A., Rajamani, A., & Fitzsimons, F.(2017). The MOVIN' project (Mobilisation of Ventilated intensive care patients at Nepean): a Quality improvement project based on the principles of knowledge translation to promote nurse-led mobilization of critically ill ventilated patients. *Intensive and Critical Care Nursing*, 42, 36-43. http://dx.doi.org/10.1016/j.iccn.2017.04.011 Database: Science Direct	-To evaluate the safety and feasibility of nurse-led mobilization of mechanically ventilated patients -To increase the number of episodes of active mobilization in mechanically ventilated patients	n = 23 nurses volunteered for the study (8 males and 15 females) with a minimum of 12 months experience in ICU. -22 bed medical and surgical ICU attached to a Tertiary teaching hospital in Australia. -Project conducted in stages over 2.5 years between April 2013 and October 2015.	-Prospective quality improvement project Instruments – Pre-training survey and post training surveys called "home-grown" questionnaires -The pre- and post-intervention phases were compared using z-test	-Early mobility on ventilated patients is safe and feasible if nurses are trained to perform. -To promote culture change, nurses must receive training and competency along with reminders, positive reinforcement and rewards. -Data collected in 46 sets (23 pre and 23 post) -Increase in mobilizations (7 out of 79 to 16 out of 46) increase of 9.7% to 34.8% before and after the strategy of positive reinforcement (p=0.0003).	- Barriers can be easily overcome by a few sessions of structured education and training programme (p. 42) - The effects of this study depend on the nurses' education, confidence, and desire to implement the frequencies of the intervention. - Different sets of challenges will be faced at different facilities.	-Positive reinforcement -Education provided to nurses - Nurse-led mobilization -Safe and feasible to provide early mobility by nurses	Level V

Citation / Search Engine Used	Purpose/ Objectives	Study population/ Sample/ Setting	Study Design/ Methods/ Major Variables/ Instruments and Measures	Result(s)/ Main Findings	Implications /critique	Comments Themes	Level of Evidence
Phelan, S., Lin, F., Mitchell, M., & Chaboyer, W. (2018). Implementing early mobilization in the intensive care unit: An integrative review. *International Journal of Nursing Studies.* 77. 91-105. http://dx.doi.org/10.1016/j.ijnurstu.2017.09.019 Database: Science Direct	-To identify factors required to have a successful implementation of early mobilization in adult ICUs and ensure sustainability.	-Database search conducted using CINAHL and Medline with the following search terms: mobility; mobile; ambulation; walking; program; quality; quality improvement; intervention; initiative; protocol. -Articles included if they addressed QI projects on implementation of early mobilization in adults (age >18years), ICU patients, require mechanical ventilation. -Exclusion – hospital wards were other than ICU, ICU patient without mechanical ventilation, and pediatric patients.	-Quantitative - Integrative review -QI-MCQS quality appraisal tool was used	-12 articles were included. -Projects took place in different types of ICUs -Nine projects implemented a mobility protocol -Four specifically identified implementing a nurse driven mobility protocol -Five projects identified new employee positions to implement -Implementation of early mobility is complex and challenging. -Strong leadership and a multidisciplinary team approach is required for success of mobilizing ventilated patients.	-Implementing early mobility in the ICU is challenging. -ICUs without dedicated staff, may require additional staff to complete mobility.	-This study included different types of adult ICUs. -Possiblity of selection bias as results were limited to mechanically ventilated adult ICU patients. -Most of the QI articles were local, single site experiences with small samples which can result in bias.	Level I

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Adler, J. & Malone, D. (2012) Early mobilization in the intensive care unit: A systemic review. *Cardiopulmonary Physical Therapy Journal*. 23(1), 5-13 Database: CINAHL Complete	-Evaluate literature related to mobilization on ICU patients. -Focused on functional outcomes and patient safety	-Database search of PubMed, CINAHL, Medline (Ovid), and The Cochrane Library with the key words: mobilization; exercise; and physical therapy; combined with ICU; and critical illness. -Inclusion- RCTs, nonRCTs, prospective and retrospective analyses, articles published between 2000 and 2011 and articles focused on adults -Exclusion – review articles, nonmobility interventions, and/or described programs or protocols designed to promote early mobility.	-Quantitative - Systematic Review -Sackett's Level of Evidence	-15 studies were reviewed -9 studies were level 4, one study was level 3, 4 studies were level 2, and one study was level one. -10 articles had concern of adverse effects (line removal, extubation, physiological responses)	-The interventions studied provided evidence that supports early mobility and physical therapy as a safe and effective intervention that has the ability to significantly impact functional outcomes of adult patients.	-RCTs studied looked at a total of 171 patients which could limit the strength of evidence -Early mobility is safe and feasible - Quality of life and muscle strength can't be identified at this time.	Level I

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Nuwi, D. & Irwan, A. (2018). Effect of active mobilization on patients in the intensive care unit: A systemic review. *International Journal of Caring Sciences*. 11(3), 1942-1953. ISSN: 1791-5201. Database: CINAHL Complete	-Explore the effect of active mobilization on muscle strength, quality of life, and physical function.	-Database search of ProQuest, PubMed, and ScienceDirect using the search words active mobilization, physical function, muscle strength, health-related quality of life, and ICU -Inclusion- RCTs in English, adult patients (>18years of age), admitted to ICU for more than 24 hours, mechanical ventilation >48 hours, and articles published between 2013-2018. -Exclusion- neurovascular disorders, head injuries, burns, spinal cord injuries, fractures, and septic shock	-Quantitative - Systematic Review -Systematic Review of PRISMA guideline and the Cochrane Handbook -Functional Status measured by Functional Status Index, muscle strength measured by a Medical Research Council score, and quality of life was measured by the Short Form Health Survey.	-Active physical mobilization didn't negatively impact either long-term or short-term patients -Mobilization improved physical function, muscle strength, and health-related quality of life after discharge. -79 articles used -6 of the articles were in different countries -6 of the articles looked at gradual mobilization -Found no negative effects on functional status -Mobility increased body function, physical function, muscle strength, walking ability, and sitting.	-Effects of physical mobility may also affect the duration of patients being mechanically ventilated, length of stay, and mental health.	-One of the studies included was coauthored by the two authors completing this systematic review which could be biased assessment risk -Requires collaboration to achieve active mobility -Looked at both gradual mobilization articles (levels/tiers of mobility) as well as generalized mobility.	Level I

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Dias de Silva Azvedo, P. & Gomes, B. (2015). Effects of early mobilization in the functional rehabilitation of critically ill patients: A systemic review. *Journal of Nursing Referencia.* 129-138. http://dx.doi.org/10.12707/RIV14035 Database: CINAHL Complete	-Determine the effects of early mobilization in functional abilities of patients admitted to the ICU	-Database search of PubMed, CINAHL, Cochrane Controlled Trial Database, Elsevier, LILACS, British Nursing Index and SciELO with the search words mobilization, mobilization, mobility, physical activity, exercise, intensive care unit, and critical illness. -Articles selected published during 2003 -Inclusion-adult, ICU patient	-Quantitative – systematic review -The Critical Appraisal Skills Programme (CASP) was used for quality appraisal.	-Safe, feasible, and facilitates functional recovery (muscle strength, performance, participation in ADLs) -Six studies were selected (two cohort studies and four RCTs) - No consensus regarding frequency, duration and intensity of mobilization. -Structured and individualized programs may facilitate recovery	-Further studies need to be completed using the same assessment tools -Limitations – complex responses of critically ill patients to their diseases, lack of consistent outcome assessment tools	-Safe, feasible, in critically ill patients after physiological stabilization	Level I

Citation / Search Engine Used	Purpose/ Objectives	Study population/ Sample/ Setting	Study Design/ Methods/ Major Variables/ Instruments and Measures	Result(s)/ Main Findings	Implications /critique	Comments Themes	Level of Evidence
Fraser, D., Spiva, L., Forman, W., & Hallen, C. (2015). Original research: Implementation of an early mobility program in an ICU. *American Journal of Nursing.* 115(12), 49-58. Database: OVID	-Assess four quality measures (falls, ventilator-associated events [VAEs], pressure ulcers, and CAUTI) as well as hospital cost, sedation/delirium measures, and functional outcomes when comparing ICU patients who received therapy from a dedicated team and those who received routine care	-One community acute care hospital -66 patients received care from the dedicated team, 66 patients received routine care, total n=132 -Medical, surgical, and coronary ICU care with 50 beds -Inclusion –18 years old, admitted directly to ICU, have an intensivist -Exclusion-inability to walk before admit, neuromuscular disease, acute stroke, BMI > 45kg/m, acute LE/unstable fx, hospice care, previous hospital<30days, Barthel Index >60 within 24 hours of admit or 24 hours of extubation	-Retrospective longitudinal study -Patients were randomly assigned to an intervention or routine care group -Sedation levels using RASS scores -Functional measurement using Barthel Index Score at admission and prior to discharge or transfer from ICU -APACHE II score -Data analyzed using PASW software with means, standard deviations, frequencies, X2 tests, independent *t* tests, and ANOVA.	-Intervention group had fewer falls, VAEs, pressure ulcers, CAUTIs, lower hospital costs, fewer delirium days, lower sedation requirements, and improved function -Intervention group got out of bed a total of 2.5 more days than controlled group -ICU length of stay was slightly shorter than control, but mean hospitalization was longer -Cost saving of $1,690 per patient (P = 0.68) -RASS of control was -2.18, intervention was -0.82 -Barthel increase from 45.9 to 85	-Study was limited to one hospital -Mobility intervention group worked 5 days of the week -Changes of intensivists during course of intervention could affect results -Propofol is usually first line sedative, but there was a shortage so Precedex used as alternative for two months -Use of precedex vs. propofol could have impacted hospital costs	-Dedicated mobility team -No adverse effects noted from study - 4 Phases of the study -Safe and viable in community hospital setting -Requires participation of physicians, PT/RT, nurses, pharmacists, and hospital administrators	Level II

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Krupp, A., Steege, L., King, B. (2018). A systematic review evaluating the role of nurses and processes for delivery interventions in the intensive care unit. *Intensive and Critical Care Nursing*. 47, 30-38. DOI: 10.1016/j.iccn.2018.04.003 Database: Found PubMed – available through Nursing & Allied Health Database	-Investigate processes for delivering early mobility interventions to adults in the ICU and the role of nurses in early mobility interventions	-Database search of PubMed, CINAHL, PEDro, and Cochrane with the search words mobility OR early mobility OR progressive mobility OR ambulation OR early ambulation OR exercise OR exercise therapy AND critical care OR intensive care OR ICU published during 2000 to June 2017 -Inclusion – description of mobility programme intitated within 7 days of ICU admit and included ambulation in ICU. -Exclusion-did not describe role of nurse in intervention or intervention started after d/c from ICU	-Quantitative – Systematic Review -SEIPS model was used to organize a synthesis of the findings -Case studies were excluded	-25 studies were included in final review – RCTs, retrospective, prospective, or mixed designs. -8 studies had established a specific mobility team -2 studies had unit champions to foster change -Several studies focused on communication between nurses and physical therapy -Tools used in mobility – mobility protocol, automatic PT consults, and specialty mobility equipment	-Further rigorous studies needed to better understand the role of nurses in implementing early mobility to maintain functional status -Safe and effective -Review highlights the need for more knowledge about the role of the ICU nurse in the delivery of early mobility in patients to maintain functional status	-Designated mobility teams of nurses, PTs, and interdisciplinary teams -Safe and effective intervention	Level I

Citation / Search Engine Used	**Purpose/ Objectives**	**Study population/ Sample/ Setting**	**Study Design/ Methods/ Major Variables/ Instruments and Measures**	**Result(s)/ Main Findings**	**Implications /critique**	**Comments Themes**	**Level of Evidence**
Ronnebaum, J., Weir, J. & Hilsabeck, T. (2012). Earlier mobilization decreases the length of stay in the intensive care unit. *Journal of Acute Care Physical Therapy.* 3(2), 204-210. ISSN: 2158-8686 Database: CINAHL	- Compare the effectiveness of two protocols (Mobility Protocol [MP]and Standard Physical Therapy [SPT]for patients with respiratory failure in the ICU	-28 patient charts reviewed -Patients were admitted to ICU with a diagnosis of respiratory distress -15 patients in the MP group, 13 in the SPT group -Inclusion-admitting dx of COPD, sepsis, CHF, or atherosclerotic disease -Exclusion-ventilator assist secondary to post op thoracic surgery, participation in experimental weaning, having an intra-aortic balloon pump, neuromuscular disorders, or died during ICU stay	-Retrospective -Physical therapy eval of all systems with ROM, strength and functional mobility. -Standard deviation and means for descriptive statistics -Mean difference in number of days on ventilator and mean difference in time on vent before PT was ordered was compared with independent t-tests with 95% CI -Forest Plots	-MP group spent of mean of 6.3 days in ICU compared to SPT group with 13.7 days (p=.007, d=1.11) -Time spent on ventilator – 8.7 days compared with 20.0 days for SPT group (p.007, d=1.09) -Physical therapy ordered on average 1.9 days earlier in MP group versus the SPT group -Decreased days in ICU and decreased days spent on ventilator equaled a savings of $22,000 per patient in the ICU	-Does not have specific length of time on a ventilator before MP is initiated – -Retrospective chart review study requires prospective study to confirm the findings of the study	-Physical therapy led -MP group has Interdisciplinary team meeting day after admission vs. SPT just having physician rounds daily -PT should start within 24 hours of MP group	Level III

Table 4
Theme Matrix for Literature Review of ICU Early Mobility

ITEM	BACKGROUND THEMES		INTERVENTION THEMES						FINDINGS THEMES				
	Addresses ABCDEF bundle	Measured initial strength and psychological	Nurses Educated	Multidisciplinary Approach	Nurse led	Designated Mobility Teams	Phases in the Study	Mobility Algorithm	Safe and Feasible	Decreased Psychological symptoms	Decreased Cost	Reduced hospital stay	Improved Functional Outcomes
Klein et al. (2018)			X	X	X		X	X	X	X		X	X
Negro et al. (2018)	X		X	X	X			X	X	X			X
Hassan et al. (2017)			X	X	X		X	X	X				X
Phelan et al. (2018)		X	X	X	X	X	X		X	X	X	X	X
Adler et al. (2012)		X				X			X	X		X	X
Nuwi et al. (2018)		X		X			X		X	X		X	X
Dias de Silva et al. (2015)		X		X		X			X	X	X		X
Fraser et al. (2015)	X	X	X	X		X	X		X	X	X	X -ICU stay reduced	X
Krupp et al. (2018)			X	X		X		X	X				X
Ronneb aum et al. (2012)		X		X		X		X	X		X	X	X

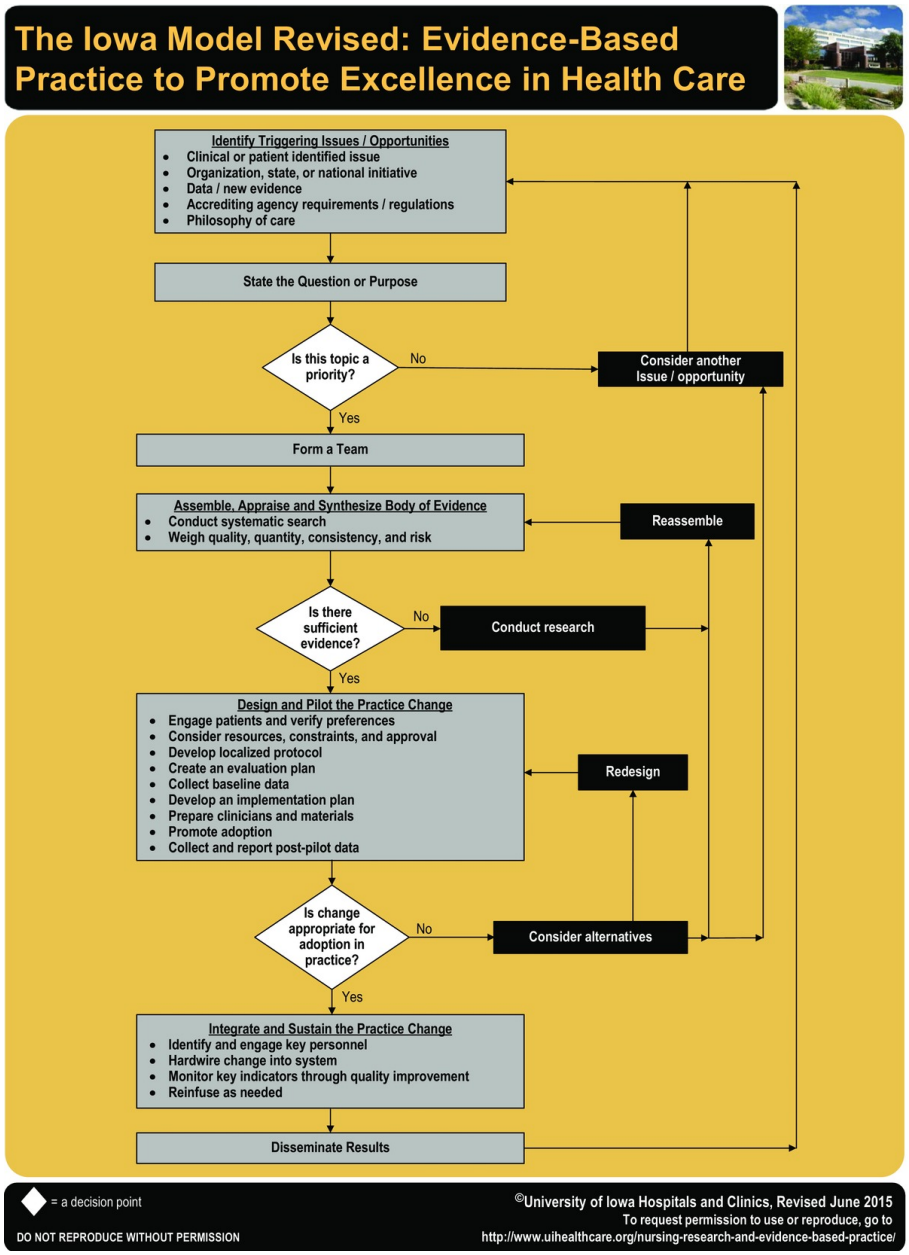

Figure 1 Iowa Model Collaborative (2017) Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing* 14(3), 175-182. doi: 10.1111/wvn.12223